

## CLAIMS

1. A producing method of a semiconductor device characterized by comprising:

a film thinning step of thinning a silicon oxide film by heating the silicon oxide film formed after a surface of a silicon substrate is etched by chemical liquid, and

a thermal oxidizing step of heating the thinned silicon oxide film to oxidize the silicon oxide film by gas including at least oxygen, or a plasma oxidizing step of oxidizing the thinned silicon oxide film by plasma discharged gas including at least oxygen.

2. A producing method of a semiconductor device as recited in claim 1, characterized in that

in the film thinning step, the silicon oxide film formed after the etching is carried out is processed at 800°C or higher.

3. A producing method of a semiconductor device as recited in claim 2, characterized in that

in the film thinning step, the silicon oxide film formed after the etching is carried out is processed at 800°C to 1000°C.

4. A producing method of a semiconductor device as recited

in claims 1 to 3, characterized in that

in the film thinning step, the silicon oxide film formed after the etching is carried out is processed under a reduced pressure.

5. A producing method of a semiconductor device as recited in claim 4, characterized in that

the reduced pressure is 266 Pa to 2660 Pa.

6. A producing method of a semiconductor device as recited in claim 4, characterized in that

in the film thinning step, the silicon oxide film formed after the etching is carried out is processed by nitrogen.

7. A producing method of a semiconductor device as recited in claim 6, characterized in that

in the film thinning step, the silicon oxide film formed after the etching is carried out is processed for 5 seconds to 60 seconds.

8. A producing method of a semiconductor device as recited in claims 1 to 3, characterized by further comprising:

a plasma nitriding step of nitriding the silicon oxide film by plasma discharged gas including at least nitrogen to

form a silicon oxynitride film, wherein

a dose amount of nitrogen of the silicon oxynitride film is made to be  $1 \times 10^{15}$  [atoms/cm<sup>2</sup>] or higher by the plasma nitriding step.